

Real-world Accident Data – Coordinated Methodologies for Data Collection to Improve Vehicle and Road Safety

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ABSTRACT

Real-world accident data is used as part of the process by which vehicles and roads are made safer. Typically data is used to identify priorities in injury prevention and to support the development of test procedures. However the provision, nature and integration of accident data with safety policy is in many cases unsystematic and not fully capable of meeting the requirements of it.

This paper examines the existing structures that utilise accident data to improve safety, and compares the existing systems in the US, UK, and EU. The paper concludes that:

Safety policy needs to take full account of real-world issues – all groups dealing with safety policy need to have a close connection to a strong accident data resource

Data collection needs to be an integrated part of the problem identification->solution generation (technical development of standards)->monitoring solution effectiveness cycle

Data systems must be designed to meet the specific objectives of the main casualty groups

Different levels of data are needed to provide a complete resource including national data, longitudinal studies and focused studies.

The levels of detail in the data gathered must match the detail in the research questions being addressed
New technologies, such as event data recorders, have the potential to improve the detail of in-depth data, but there are obstacles from lack of standardisation and privacy regulations.

The paper proposes:

New system of accident and injury data to integrate with EU structures

Coordinated international approaches to accident data within the framework of EEVC and IHRA

Specific technical areas, including collision severity assessment and injury scaling, where new advances are required to accurately describe injury causation

INTRODUCTION

Annually within the European Union, there are over 40,000 road accident fatalities and 1.6 million other casualties. Such accidents cost the Community over 160 billion Euros annually. If the additional road toll of approximately 23,000 persons killed each year in the EU's associated states were to be taken into account, the annual socio-economic cost would be around 250 billion Euros.

The development of a Community-wide road accident database is strongly supported by safety professionals as an essential tool for informed decision-making to effectively combat the huge road safety problem throughout the European Union. The collection of disaggregated data would enable flexible and broad analyses of a large number of variables. It would provide at EU level the base level data set needed to produce international comparable data on road crashes. It would enable objective assessment of the true size of the road safety problem, the identification of areas for countermeasures having the largest potential for safety benefits, and contribute to the evaluation of the effectiveness of those countermeasures.

THE CO-ORDINATED APPROACH

At a broad level, data on the numbers and types of crashes occurring are needed to identify and order priorities and to understand the scale of the problem. At a more detailed level, an understanding of the circumstances resulting in crashes is needed to inform safety policy. Further still, knowledge of the

injuries sustained and their causes provides an essential tool to monitor the consequences of changes in vehicle structures and to give feedback on the effectiveness of countermeasures. This knowledge will also enable safety strategy engineers within industry to produce improved design solutions. This co-ordinated approach is shown in table 1.

Table 1.
Levels of Data Needs in the EU

Level	Main Source of Data	Functions
Base Level	Traffic police accident reports National road transport statistics	To assess accident situations (who, where, when, what); To examine trends in traffic volume, risks and accidents, make forecasts; To evaluate the effects of legislation and other countermeasures
Intermediate level	Traffic police accident reports Observations at sites Additional evidence from witnesses Judicial reports	To identify and diagnose hazardous road locations (where, how, what) To reconstruct accidents and determine useful countermeasures
In-Depth level	Traffic police accident reports Observations at sites Additional evidence from police Officers or witnesses Interviews with road users involved Clinical assessment of injuries Technical inspection of damage	To assess accident causes To assess accident causation mechanisms To study accident and injury prevention measures To further knowledge on vehicle safety, human tolerance and mechanism of injury (injury tolerance) To monitor the effectiveness of specific legislation and legislative measures.

In practice there is a continuum between the level of detail and the quantity of accident data. Resources are normally limited so that in any one database it is possible to have large numbers of cases with little detail or few cases in considerable detail. The choice made depends on the nature of the research questions to be addressed and also the manner in which the database can be integrated with others to form a complete picture of injury and accident causation. Clearly no single accident database will address all of the information needs of policymakers, as the range of questions is so diverse. A co-ordinated safety network approach offers the best means to gain maximum value out of each separate system and to make use of synergies based on links between the general database and other more specialised databases. The coordinated safety network approach will build these statistical links but it will also ensure that each relevant combination of detail, numbers of cases and accident and injury coverage is included within an overall structure.

Such an approach already exists within the US National Automotive Sampling System (NASS) (Table 2) where there are different levels of data

collected on a national basis with each providing a unique input into the policy-making agenda. In the NASS study, data are collected at a number of levels, specifically the General Estimates System (GES), the Crashworthiness Data System (CDS) and the Crash Injury Research and Engineering Network (CIREN) system.

General Estimates System

At a general level are data that are collected as part of the General Estimates System. This Federally system of data collection began operation in 1988. Providing data about all types of crashes involving all types of vehicles, the GES is used to identify highway safety problems areas, provide a basis for regulatory and consumer information initiatives, and form the basis for cost and benefit analyses of highway safety initiatives. The GES obtains its data from a nationally representative probability sample selected from the estimated 6.4 million police-reported crashes that occur annually. These crashes include those that result in a fatality or injury and those involving major property damage. Although various sources suggest

that there are many more crashes that are not reported to the police, the majority of these unreported crashes involve only minor property damage and no significant personal injury. By restricting attention to police-reported crashes, the GES concentrates on those crashes of greatest concern to the highway safety community and the general public.

Fatality Analysis Reporting System

The FARS system provides a comprehensive census of all fatal crashes in the US. State based arrangements supply data based on police reports and related sources. It is Federally funded and one of the two primary crash analysis resources used in the US. Its strengths come from the wide ranging but systematic nature of the data recorded and its derivation from the conventional approaches used as part of the standard police operating procedure. Typically over 40,000 casualty records are added to the file each year and the data has been used to support policy direction on many aspects of road and vehicle safety. Its rigorous sampling basis gives a strength that results in many opportunities for precise statistical analysis.

Crashworthiness Data System (CDS)

At an intermediate level the Crashworthiness Data System data are collected. Federally funded field research teams located at Primary Sampling Units (PSU's) across the country study about 5,000 crashes a year involving passenger cars, light trucks, vans, and utility vehicles. Trained crash investigators obtain data from crash sites, studying evidence such as skid marks, fluid spills, broken glass, and bent guardrails. They locate the vehicles involved,

photograph them, measure the crash damage, and identify interior locations that were struck by the occupants. These researchers follow up on their on-site investigations by interviewing crash victims and reviewing medical records to determine the nature and severity of injuries.

Crash Injury Research and Engineering Network (CIREN)

A third level of data collection are those data that are obtained as part of the CIREN study. This study is a network of medical and engineering researchers working on safety at leading trauma centres. It is funded as a joint activity between the Federal Government and the automotive industry. There are 10 CIREN Centres in the US which have been organised into a Network for the collection, analysis, and sharing of crash injury data. In this study, key in-depth data including X-ray, MRI, and CAT-Scan images are organised in a core repository so that all centres can review the status of cases across the network. Cases, in whole or in part, may be reviewed electronically so that individual centre expertise may be shared in evaluating a case. They are selected from hospital based sampling systems and focus on crashes involving life-threatening injury. Videoconferences are periodically conducted wherein cases are reviewed simultaneously across multiple centres.

At a general level, the data systems act in a complementary fashion to one another. In additions, the data collection protocols are the same in each of the states and this offers significant advantages in terms of data analysis, purpose, interpretation and dissemination.

Table 2.
National Automotive Sampling System

Data Description	Coverage
General Estimates System (GES)	Sample of 55,000 police reported accidents, weighted for national estimates (Basic information on road user types and minimal accident causation information)
Fatality Analysis Reporting System	Census of all police reported fatal crashes with data derived from police reports and related information.
Crashworthiness Data System (CDS)	Stratified sample of 5,000 injury, tow-away accidents, weighted for national estimates (principally crash injury data)
Crash Injury Research and Engineering Network (CIREN)	In-depth crash injury data based on seriously injured casualties (solely crash injury data)

While the US system is not directly transferable to the European context, it illustrates the principle of the

co-ordinated approach (NHTSA, 1995, 1996). A small number of European Member States utilise an

equivalent integrated approach. For example, The UK Department for Transport (DfT) funds the Co-operative Crash Injury Study (CCIS) together with a group of industry partners. The CCIS includes data collection of 1,500 accidents annually to monitor the causes of car occupant injuries and the effectiveness of safety countermeasures. The DfT has also recently implemented a new study using on-the-spot methods to explain the causes of accidents and pedestrian injuries and the two databases are related to the national accident database - STATS 19. In Germany, the Medical University of Hannover conducts research into injury and accident causation by investigating around 1,000 accidents annually, and this database is again linked to the national accident database maintained by the German Federal Highway Research Institute (BASt). Both UK and German in-depth studies use a statistical sampling approach to ensure the in-depth samples are related to the national accident population defined by the national database. In both countries the in-depth crash investigations are basically a research activity.

Building blocks for a European Accident Database

European data requirements need to take account of EU competence for road safety that covers to some degree all parts of the traffic system. The EU has explicit Treaty obligations to act on road safety. It has exclusive powers for ensuring both a high level of protection in car and motorcycle technical standards (Article 95) and the competence to act in any other area of road safety where the EU can add value over and above the efforts of Member States (Article 71). The EU has also established competence in several areas since the 1980s such as seat belt use in cars and driver licensing. The main area of responsibility of the EU is in setting and adapting to technical progress requirements for the EU Whole Vehicle Type Approval (EUWVTA) of vehicles. This covers cars and motorcycles now but it may be extended to buses and goods vehicle before long. Measures focus on the pre-crash phase on handling, braking and lighting, and the crash phase in which the main factors are those of crashworthiness, both structural (roadside furniture and vehicle) and occupant protective equipment performance. Historically, the crash protection measures have been proven more effective mechanisms to reduce car occupant crash injury. Unlike handling, braking and lighting, crash protection measures do not rely on appropriate driver behaviour to deliver benefits. This balance of focus between accident causation and injury causation will also depend on the nature of the road user and existing political activity. On the one hand, there are

many engineering opportunities to reduce car occupant injuries and this has been the main area of regulatory activity. While this may gradually change with time, the existing need is for an in-depth injury focussed data system. There is also a need for injury and accident causation work aimed at improving the safety of motorcyclists, pedestrians and cyclists. Future crash data needs will increasingly focus on the development of new vehicle and infrastructure based crash avoidance systems. At policy level there is a pressing need to ensure data and analysis tools are available to ensure that new technologies do result in real casualty reduction. Increasingly there will be requirement to assess progress of all safety stakeholders against targets. Nevertheless the impact of active safety systems is not likely to be great within the timescale of the current EU casualty reduction targets and passive safety approaches will continue to predominate in effectiveness.

EU data requirements

The EU needs several data sets in different levels of detail to support its activities. There is a need for the basic counting of crashes, injuries and fatalities in a similar way to national systems; this need is being covered by the CARE project. At a more detailed level there is a demand for information on the main area of EU competency in road safety, that of vehicle safety standards and road user injury prevention. Regulations that exist in this area are all detailed in their specification and in the requirements they place on the vehicle, thus the data needed to provide feedback and future direction must also be detailed. Information about injuries has to come from hospital records but additional, linked data are needed to put injuries into the context of vehicle design and accident causation. The data have to be sufficient to provide a reliable feedback yet also detailed enough to provide accuracy. The complete range of road users should eventually be addressed, although primarily, the main casualty groups are car occupants, pedestrians and two-wheelers. Initially, the focus of new in-depth accident data collection should be crashworthiness and injury causation so that it remains manageable but this should be expanded to include relevant aspects of accident causation with time.

A number of building blocks towards the integrated accident data system already exist. Most particularly the CARE database is part way towards providing a system that will enable basic counts of fatalities and reported casualties of all severities as well as provide basic details of the reported crashes. The STAIRS project, funded under the Fourth Framework Programme (Ross et al) researched the need and possibilities for an in-depth crash injury database to

set the safety priorities in vehicle design and to provide feedback on regulation effectiveness. The Safety Rating Advisory Committee (SARAC) study will develop a methodology for rating the safety levels of car models using mass data such as national accident databases or insurance files. Each of the building blocks and their corresponding activities and needs are further discussed later. The most important gaps in the existing EU accident data provision are in the areas of:

- Underreporting of single vehicle and injury accidents;
- In-depth crash injury database;
- Database linkage of hospital injury data and police accident data; and
- Systematic collection of exposure data.

The wider system envisaged, describing the injuries sustained by all road users and linked to summary information about the crash and vehicles involved, will provide a substantial, broad view of the crash injury situation. Moreover, it would enable the estimation of the underreporting of injuries in the police accident data. This is needed to avoid misguided road safety priorities due to the relatively much higher underreporting of vulnerable road user casualties (ETSC, 1994; OECD-IRTAD, 1994). Any database must be independent of the major stakeholders, defined as those groups that have a financial stake in the research outcome, if it is to be used to inform policy and evaluate the effectiveness of safety systems in an impartial way.

The CARE Database – Disaggregated Data

The CARE database comprises statistical information of reported road accidents in the European Union resulting in injury or death. The Council Decision (93/704/EC) requires Member States to establish road accident statistics and to communicate these data for a given year to the Statistical Office of the European Communities. The European Commission reported on the outcome of the first three years of CARE in COM (97) 238 final. (European Commission, 1997) The database comprises annual national sets of accident data in their original form supplied by all the 15 Member States without harmonisation of individual variables. The Commission and Member States' aim in the pilot has not been to harmonise database variables, but rather to provide a framework of transformation rules in CARE to increase database compatibility using the methodology developed by the CARE PLUS group. CARE is different from other international databases in that it contains data on individual accidents i.e. disaggregated data. To minimise both the time taken to implement the database and the inconvenience to the national administrations, the national data sets are integrated

into CARE in their original national structure and definitions but without any confidential data. A framework was designed to enable access to the data at EU level. Accident reports contain detailed information on accident location, injuries and vehicle, but the level of detail, the definitions and the number of variables vary significantly between the Member States. At the start, the process for data compatibility was very basic. Using the classifications in Table 1, CARE is an example of a base level database for the EU. Each Member State is responsible for the quality of its data and is requested to validate its data after inclusion in the CARE database. In this way, it can be assured that the information from the CARE database corresponds to the information extracted from the national database. CARE PLUS reported in June 2000, and proposed the extension of harmonisation of the national data, redefining the national variables into common variables, to include:

Location (urban, motorway, junction, type of junction)
 Date and time
 Light/weather conditions
 Collision type
 Accident severity
 Type of vehicle(s) involved
 Description of person(s) involved (driver, front/rear seat passenger, pedestrian)
 Age and gender of those involved
 Injury severity of those involved
 The supplementary data from CAREPLUS 2 will include:
 Country of registration
 Nationality
 Vehicle age
 Driver experience (length of time license held)
 Road surface
 Road condition
 Region, province
 Speed limit.
 Alcohol test
 Alcohol test result
 Carriageway type
 Pedestrian/driver/vehicle manoeuvre.

Good progress has been made in the development of CARE and the principal need now is to start deriving useful information from the databases and to improve access. The principal use of the CARE database lies in the statistical monitoring of developments and comparative analyses of national differences in variables and types of fatalities. Due to the different (under) reporting levels of injuries and accidents sustained by different types of road users in each country of the EU, the CARE database cannot be

meaningfully used for comparative analyses of injuries. However, the CARE database is indispensable since it contains the disaggregated data as comparably defined records on individual accident and casualties from each EU Member State. As such, it is much richer than the aggregated data in a limited number of cross-tabulations from the IRTAD database of the OECD. The CARE fatality database contains almost all road fatalities in the EU and its functional use is comparable to the Fatality records in the GES in the USA. However, in contrast to the GES system, its actual usefulness is hampered by the restrictive policies for access by the national authorities, whereby most leading road safety research institutes in the EU are not allowed to use the data. This is a serious drawback for the research exploitation of the wealth of information contained in the CARE fatality database. Moreover as national experiences show, flaws in such databases are mainly detected by comparative research. These can then be cured.

The IRTAD Database – Aggregated Data

Since 1988, the International Road Traffic and Accident Database (IRTAD) has been maintained by BAST (Germany) under the auspices of the OECD. The principle sets of road traffic and accident data available for 29 countries on a yearly basis from 1970 onwards are:

Population figures with a breakdown by age groups and single age bands (15-20).

Vehicle population with a breakdown by vehicle types.

Kilometrage classified by network areas and vehicle types.

Number of injury accidents classified by road network areas.

Fatality figures with a breakdown by types of road user, age and network areas.

Hospitalised with a breakdown by types of road user, age and network areas.

Network length classified by network areas.

Seat belt wearing rates by network areas.

Modal split.

Area of State.

Risk values: fatalities, hospitalised and injury accidents related to population or kilometrage figures.

Monthly accident and injury data (three key variables).

The data, provided by relevant national institutes, are constantly checked for consistency within countries and over years. IRTAD is a traffic accident analysis tool that stimulates international standard definitions and spurs improvements in data collection and

comparison. For example, the number of fatalities is available in corrected form (30 day recording period). Member countries were repeatedly encouraged to adopt the 30-day limit for the definition of a fatality and most countries have now complied. The definition for a seriously injured person as "hospitalised" (non-fatal victims who are admitted to hospital as in-patients) is to some extent workable, but nationally different registration coverage of seriously injured persons is present.

The IRTAD database is used as a prime source of international data required for annual reports and ad hoc studies at the aggregated level. The main advantage lies in the ease of quick reference. It allows the development of safety indicators and is used as an analytical tool for statistical comparisons and road safety policy formulations. It is the quickest way to achieving the goal of reliable, comparable and consistent traffic and fatality data for nearly all OECD countries. To be internationally representative on a global scale, IRTAD is open to all non-OECD member countries. The database is used by a wide range of public and private institutes on CD-ROM or on the Internet.

Injury Reporting System

In several EU countries, mostly in the northern and western regions, clinical hospital data on traffic injuries are linked with the police reported accident data on a national or regional level. This serves two purposes: (1) establishing the underreporting of registration of injury accidents by the police and (2) adding the detailed injury information to the registered data of accidents. It is generally believed that almost all fatalities are registered, but a German study (Metzner, 1992) on linked hospital and police data estimated that up to 5 per cent could be missing from police data. A French study (Laumon et al., 1997) for the region of Lyon established that as many as 12 per cent of fatalities were underreported in the official police based registration. In Nordic countries, Great Britain, Germany and the Netherlands several studies on linked hospital and police data (see OECD-IRTAD, 1994, for summary) have revealed that many injuries from single vehicle accidents and injuries of pedestrians and cyclists are underreported to a varying extent in the official road accident registration systems of these countries. On average between 20-40 per cent of all serious injuries are not reported, while the largest underreporting with respect to all (slight and serious) injuries is generally observed for cyclists. Up to 80 per cent of injured cyclists in traffic accidents are not reported. For the southern countries of the EU, no such studies on the completeness of the official registration of road accident injuries and fatalities are available. It is

evident that the statistical analyses and the monitoring of developments from the injury accident data in the national databases, and thus also from the CARE database, will be misleading, unless detailed corrections for fairly well known underreporting percentages are made. Therefore, it is urgently recommended that, in the short term, similarly designed national studies on the underreporting of injuries are periodically performed in every country of the EU. This will add value and so should be financially sustained and co-ordinated by the EU. The aim is that comparative national correction factors can be applied to the types of injury data in the CARE database to obtain reliable information on road injuries. This would then allow the correct estimation of the actual economic costs of road accidents (now probably underestimated by several tens of percentage points) and the proper priority setting for road safety improvement.

In-Depth Crash Injury Databases

In-depth crash injury databases contain the necessary post-crash information for causal analyses of injury patterns in crashes. They contain the detailed injury and vehicle crash data generally gathered by teams of medical and technical experts and police specialists soon after a severe accident. These combined details of injury and vehicle deformation data of severe road accidents are indispensable for input to safety regulation on vehicles and restraint systems, which is the prime competence of the EU in the field of road safety. These databases exist for selection of severe accidents in a few regions of some countries in the EU, some states of the USA, and in Japan, especially where car industries are located. The STAIRS project, funded under the Fourth Framework Programme, identified the need for a joint European in-depth crash injury database to set the safety priorities in vehicle design and to provide feedback on regulation effectiveness. The study also observed that there was a need for further work to refine certain crash investigation tools, particularly in the area of collision severity estimation, impairment measurement scales and analytic methods. A further limitation concerns the routine conduct of post-mortem investigations in the case of fatalities. In some Member States this is performed as a routine event in the case of unexpected death and these reports can be used to provide essential information on causes of death. In some countries, however, this is not routine and the data on this important casualty group are missing. These countries should be encouraged to conduct post-mortem investigations where the data can be used to inform EU or national priorities.

Finally, although many of the data collection activities needed are primarily European, there is a need to build a wider international consensus on accident data, particularly at the levels of counting crashes and also in-depth data. Other territories, such as the USA, Canada, Japan and Australia, all have on-going studies at both levels and, as there is a deeper involvement of the EU in WP 29 in Geneva, there will be a need for a common understanding on the strengths and limitations of the data. The STAIRS project has made great progress in defining the essentials for a European in-depth crash injury base and its statistical selection correction factors. The protocol forms the basis of comparability many data collection systems including those in the UK, France, Germany, Australia, Sweden, Finland, Austria and the Netherlands. Although some organisations with regional in-depth crash injury databases in several EU countries have agreed to cooperate and to work towards harmonisation of their databases, it is still a major task to initiate a completely pan-European in-depth crash injury database. Therefore, it is to be recommended that the EU initiate the first phase of work by initiating actions in a limited group of countries and then continuing to build once the system is operating satisfactorily.

Accident Causation Databases

Accident causation databases differ from the previously discussed databases in that they contain the necessary details of the pre-crash data, where the other databases either contain hardly any data on the pre-crash phase of the accidents or only post-crash data. Self-evidently pre-crash data are indispensable for the analysis of effective countermeasures to prevent road accidents. Since the focus on the relevant pre-crash data generally differs for accidents of different road users, there are activities on accident causation data gathering for car accidents, for motorcycle accidents and pedestrian accidents; the latter two for obvious reasons also include data that are relevant for the causation of injuries. Some national accident causation studies have been carried out in several Member States, either in connection with the in-depth injury causation work (e.g. Medical University of Hannover) or by the police in routine recording of accidents and casualties in the national accident database system (eg. Great Britain).

CAR ACCIDENT CAUSATION

The Association of European Car Manufacturers (ACEA) conducts a European Accident Causation Survey on car accidents with financial support from the European Commission. The focus on research interests of the car manufacturers for this study on the

pre-crash conditions of car accidents is quite understandable, since improvement of pre-crash conditions may focus more on road infrastructure as much as vehicle design. However, as stated earlier, great care must be taken that any database is independent of the major stakeholders if it is to be used to inform public policy and evaluate the effectiveness of safety systems in an impartial way. It is recommended that further initiatives of the EU on car accident causation databases and research looking at vehicles and infrastructure are undertaken in a way that guarantees participation and management by independent parties albeit in cooperation with private sector stakeholders.

Future directions in crash avoidance involve the development and implementation of many technologies that have the potential for casualty reduction and a representative research in-depth database is needed to ensure that strategic decisions over systems development are directed by estimates of casualty reduction under real-world conditions.

Pedestrian accident and injury causation

Within the European Accident Causation Survey of the ACEA and in a small number of independent studies (OECD, 1998), data are gathered on the causation of pedestrian accident and injuries. An ACEA study on the cost effectiveness of pedestrian-friendly car fronts in comparison to road infrastructure countermeasures prompted critical comment from the Forum of European Road Safety Research Institutes (FERSI) in the form of a letter, that illustrated the importance of impartial databases and research. It is recommended that the EU take initiatives towards setting up a European database on pedestrian accident and injury causation.

OTHER RELATED INFORMATION

Exposure statistics

In order to be able to compare safety levels of road modes and road types of countries in the EU, the number of user/passenger/vehicle kilometres of the road modes on the road types of Member States must also be known. Risk assessment is not possible without this exposure data, nor the priority setting for road safety, as has been discussed extensively by the ETSC (ETSC, 1999.).

In several countries of the EU these exposure data are not gathered or only partially and/or unreliably gathered. For example, in Greece, where in recent years exposure data are gathered, the data imply an annual kilometrage of over 22,000 km. per motor vehicle. This is probably incorrect since the average of the other countries in the EU is about 14,000 km. Therefore, the recommendations of the ETSC (ETSC,

1999) on the comparable gathering of exposure data in all countries of the EU are again brought to the attention of the European Commission and Member States.

Need for European activity

Currently research groups, national organisations and industry are investigating crashes and collecting accident data. Each activity has a specified purpose and the structure of each system is optimised to meet that purpose efficiently. These systems do not however serve a European regulatory purpose so well and there is now a clear need for more co-ordinated European action as much decision-making is now taking place on a European scale. Since 1996, the European Commission has overall competence in terms of vehicle safety legislation through the Whole Vehicle Type Approval procedure and this currently covers cars and motorcycles. This places a responsibility on the Commission to ensure that appropriate safety standards are in place to ensure a high level of safety and this has been reinforced through the discussions over the European Union signing the Geneva Agreement. The Commission also has a duty to develop a road safety strategy for Europe, although the responsibilities must be shared with Member States. Finally, it also has competence for driver licensing issues. As part of this policy making, there is a continuing need to monitor and evaluate the effects of regulation and safety actions. Feedback will always be an essential component and has recently been included within the Front and Side impact Directives. In order to develop policy there is a need for a comprehensive set of crash injury databases to inform policy makers, direct the engineering development of new test procedures and to provide feedback on the effectiveness of existing regulation. The decisions over vehicle designs are made on a European scale, the industry is either European or global, and it operates over many territories. Most industry groups do not utilize any systematic pan-European crash investigation and most frequently have to generalize based on regional or even local accident data. The availability of systematic accident data will also support the industry decision-making and could provide a more substantial common ground for government-industry discussions. In the field of vehicle design and crash protection there has been a very rapid rate of technological development over the past ten years. It has often not been possible for government or industry to conduct sufficient accident data to confirm that one generation of systems is effective before the new generation is being sold. One example concerns airbag systems, which were introduced to reduce driver injuries in mass-market cars in 1992,

but it was not until 1996 that the first results on injury reduction became available. There is still no estimate of fatality reductions from airbag systems and the limiting factors are generally the small numbers of crashes investigated by any one group and also the untargeted approach that means that most crashes and vehicle types are included in a sample. Extending the crash data samples to cover a wider geographical area and restricting eligible cases to those that offer greater research value can improve the efficiency and speed of feedback. A database that only includes information on newer vehicles will provide as much useful information as one that is much larger but unselective. By combining results from a number of sample areas, it is possible to build a larger sample and obtain statistically significant results more quickly using a targeted approach on a European basis.

The primary focus of this review of crash data requirements has been the member states of the EC however many of the issues that have been discussed are relevant for many other territories. Indeed policy decisions are increasingly being made at the global level, for example based on the 1958 Geneva Agreement where many vehicle design and regulatory issues are resolved. Data that is gathered in the UK may not be directly comparable with Japanese or US data as a result of different methodologies and there are many instances where different national priorities can be attributed to either real differences in crash populations or artefacts from different data collection protocols.

CONCLUSIONS AND RECOMMENDATIONS

Some progress has been made so far with the development of road accident databases and Community action now needs to develop as follows:

1. Continued development and support of the CARE/CAREPLUS programme with target-setting to expand the numbers of common variables within CARE, development of the convergence of the various national data sets and provision of regular estimates of under-reporting for non-fatal crashes, particularly for the seriously injured.
2. Widened access to the CARE database presently restricted by EU or national rules, at least to all relevant road safety research institutes within the EU.
3. Establishment of a limited scale in-depth crashworthiness data collection programme (such as the PENDANT programme) to demonstrate the value of car crash injury data to the regulatory process. Implementation of a demonstration project to review future EU safety priorities.

4. Establish an injury and accident-reporting system, based on linked hospital and police information. Implement a demonstration project to identify injury priorities and changes in injury patterns due to vehicle design changes.
5. Review existing data collection activities in the areas of car, motorcycle and pedestrian accident causation to establish the value of data and their relevance to the competencies and priorities of the EU.
6. Ensuring that groups who do not have a stake in the financial consequences of the investigations conduct data collection and analysis. EU financial support for database activities should be made conditional on the established impartiality of those responsible for managing them, as well as appropriate access.
7. Encouragement and financial support for the collection of exposure data.
8. The setting up of a website-based road safety information system for public use comprising aggregated fatality, exposure and risk data for road transport in all EU Member States, information on national and EU road safety policies, laws (such as year and level of permitted alcohol, speed limits etc.), recent, important research results as well as an annual EU report on road safety developments.
9. There is a need for an international dialogue to assess comparability between accident datasets and to derive harmonised methods of analysis. The STAIRS protocol, already used in many countries, provides a good basis for in-depth crash injury data gathering.

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